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Fast Track to Atlantis

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Sea levels on earth have risen and fallen periodically since the most recent glacial maximum approximately 20,000 years ago.[1] In recent times, human activities have influenced global warming through fossil fuel combustion, deforestation, and industrial emissions.[2,3] Through increasing atmospheric concentrations of greenhouse gases, this recent global warming has likely contributed to sea level rise from thermal expansion of seawater, widespread glacier retreat, and loss of ice sheets in Greenland and Antarctica.[1] In the 20th century, the average global rate of sea level rise was in the range of 1.0 to 2.0 mm per year.[1] Projected sea level changes from 1990 to 2100 include a rise of 0.48 m with a regional range of 0.09 to 0.88 m. This represents a 2.2- to 4.4-fold increase from the average rate of change in the 20th century.[1–3]

What will be the impact of sea water rises over the near future on people living in large urban centers? For this exercise, population projection scenarios were constructed to estimate the number of persons at risk to 2050. Large urban centers at risk of flooding were defined as urban areas with a population of 750,000 or more in the year 2000 that were within 5 km of a coastline or a major river. From 2000 to 2015, data were obtained directly from estimates produced by the United Nations.[4] From 2020 to 2050, population estimates were derived by extrapolating quinquennial population estimates from point estimates of urban agglomerations going back to 1950. Country-specific population estimates and projections for the years 2000 through 2050 were obtained from the US Census Bureau's International Database.[5]

In 2000, a total of 427 urban centers in 68 nations had populations of 750,000 or more. Of these, 136 (31.8%) were determined to be at future risk of flooding over the next 50 years. We estimated that the at-risk populations in these 136 urban areas will increase from 329 million in 2005 to 600 million in 2050. Of the 68 nations with urban large centers, 45 (66.2%) will have 75% or more of their urban populations in 2050 living in areas at risk of flooding. The 5 countries with the greatest proportion of their urban agglomeration population living in at-risk areas are Bangladesh, Philippines, Cote d'Ivoire, Thailand, and Australia; the five largest at-risk nations are China, India, Brazil, United States, and Bangladesh, with populations at risk ranging from 189 million to 55 million in 2050.

There are a number of potential health implications of a rising sea level. First, in the future there could be a significant population shift away from regions at high risk of flooding to areas less prone to this phenomenon. For example, if areas such as the Nile Delta and Bangladesh are flooded and as low-lying island states in the Pacific and elsewhere become immersed, tens, if not hundreds, of millions of people will be driven elsewhere.[6] Overcrowding in these areas could also increase the incidence of respiratory infection, parasitic communicable diseases, and psychological disorders.[1,2]

Second, the rise of sea level could disrupt water purification as saltwater encroaches on the freshwater supply.[2] Underground water tables may be lost in many regions, such as the western United States, while storm water drainage and sewage disposal could be disrupted.[6]

Third, there could be some changes in the geographic distribution of vector-borne diseases. Malaria, for example, may emerge in many new regions due to stagnant water and poleward migration of the 16°C–18°C winter isotherms.[6]

Last, large-scale decreases in agricultural output in coastal areas may also occur as croplands become inundated or coastal farmland soil becomes increasingly saline.

In conclusion, the number of people living in urban areas at risk of flooding could increase significantly over the next 50 years. This increase will occur in countries like Bangladesh, Philippines, and Cote d'Ivoire, which will be least able to afford it.

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